

# **C02 Huff-n-Puff Process in a Light Oil Shallow Shelf Carbonate Reservoir**

**Quarterly Report  
April 1 - June 30, 1997**

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**CO<sub>2</sub> HUFF-n-PUFF PROCESS  
IN A LIGHT OIL  
SHALLOW SHELF CARBONATE RESERVOIR**

(No. DE-FC22-94BC14986--16)

**QUARTERLY TECHNICAL PROGRESS REPORT**

Texaco Exploration & Production Inc.  
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Program Manager:	Scott C. Wehner
Principal Investigator(s):	Scott Wehner Mark Kovar
Contracting Officer's Representative (COR):	Jerry Casteel / BPO
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## OBJECTIVES

The principal objective of this CO<sub>2</sub> Huff-n-Puff (H-n-P) project is to determine the feasibility and practicality of the technology in a waterflooded shallow shelf carbonate environment. The results of parametric simulation of the CO<sub>2</sub> H-n-P process, coupled with the Central Vacuum Unit (CVU) reservoir characterization components will be used to determine if this process is technically and economically feasible for field implementation. The technology transfer objective of the project is to disseminate the knowledge gained through an innovative plan in support of the Department of Energy's (DOE) objective of increasing domestic oil production and deferring the abandonment of shallow shelf carbonate (SSC) reservoirs. Tasks associated with this objective are carried out in what is considered a timely effort for near-term goals.

## BACKGROUND

Texaco Exploration and Production Inc's. (TEPI) has mid-term plans are to implement full-scale miscible CO<sub>2</sub> projects in the Permian Basin of West Texas and Southeast New Mexico. The economic market precludes acceleration of many such capital intensive projects in many cases. This is a common finding throughout the Permian Basin SSC reservoirs. In theory, it is believed that the "immiscible" CO<sub>2</sub> H-n-P process might bridge these longer-term "miscible" projects with near-term results. A successful implementation would result in near-term production, or revenue, to help offset cash outlays during the initial startup of a miscible flood. The DOE partnership provides some relief to the associated R & D risks, allowing TEPI to evaluate a proven Gulf-coast sandstone technology in a waterflooded carbonate environment. Numerous sites exist for widespread replication of this technology following a successful field demonstration.

TEPI concluded all of the Tasks associated with the First Budget Period by October, 1995. The DOE approved the TEPI continuation application. Budget Period No. 2 is in progress. Initial injection of CO<sub>2</sub> began in November, and after a short shut-in period for the soak, the well was returned to production in late December, 1995. Monitoring the results of the first demonstration continued through mid-year 1996. This report identifies a new site where the demonstration project is progressing.

## SUMMARY of TECHNICAL PROGRESS

### *FIELD DEMONSTRATION:*

**Results from Initial Demonstration Site.** The CO<sub>2</sub> Huff-n-Puff process has not met with successful results at the initial demonstration site at CVU. As mentioned in the previous report, there are several reasons contemplated as to the reasons behind the results. Most notable is the fact that other San Andres locations which have been operating Water-Alternating Gas injection have seen marked reductions in injectivity on the water cycle, while operators within the Vacuum field have not. If there is a relation, as hypothesized in some industry literature, then rather than conclude this demonstration with inconclusive results, TEPI proposed further investigations. The Vacuum reservoir may not be amenable to trapping of CO<sub>2</sub> gas in the matrix.

**New Site.** A new demonstration site at the Sundown Slaughter Unit (SSU) in Hockley County, Texas has been approved by the DOE. SSU is also a shallow shelf carbonate reservoir that is currently under miscible CO<sub>2</sub> injection in the Eastern portions of the field. The final demonstration cycles of this project would be conducted in the western portion of the SSU where CO<sub>2</sub> flooding operations have not yet been expanded, therefore having no influence on production. Miscible injection operations in this field have experienced the

reduced injectivity with CO<sub>2</sub> WAG operations as similarly seen elsewhere within the Permian Basin. The very pronounced injection hysteresis effects experienced at SSU suggest the ability for CO<sub>2</sub> to form a near-wellbore gas saturation. A field map showing the demonstration site, well number 1341, and current miscible flood operations is provided as **Fig. 1**.

Well 1341 was drilled in 1984 and cased with five and one-half inch casing to TD at 5032'. The San Andres Formation was perforated over a fifty-three foot interval with 2 jet-shots per foot. The primary criteria in choosing a Huff-n-Puff candidate at SSU included, (1) reservoir quality as indicated by porosity-feet of pay and offset well performance; (2) casing condition; many wells at SSU have had casing leaks, particularly the older wells; (3) proximity to an existing pipeline source of CO<sub>2</sub>; (4) current production rate. It was felt that a high total fluid rate indicated good permeability. A low oil cut was desirable since any incremental oil produced could be considered tertiary oil, and parametric simulations suggested better recoveries making it easier to evaluate the success of the project; and (5) proximity to existing horizontal wells and CO<sub>2</sub> injectors that might cause interference. Texaco did not want any abnormal influences affecting the results of the test. CO<sub>2</sub> injection for the Sundown Slaughter demonstration site began on June 16, 1997 in well No. 1341. Through June 30, 1997, a total of 9.7 MMscf has been injected into the first demonstration site at SSU. It is planned that a total of 50 MMscf of CO<sub>2</sub> be injected into well No. 1341.

## **REFERENCES/PUBLICATIONS**

The Petroleum Recovery Research Center continues to provide updates on the project in its quarterly newsletter. In addition, the Petroleum Technology Transfer Counsel, a joint venture between the Independent Producers Association of America (IPAA) and DOE is providing complete quarterly and annual Technical Reports on an Industry Bulletin Board called GO-TECH. This is allowing a more timely dissemination of information to interested parties.

A review of the project performance and results to date was presented in Houston, Texas on June 18, 1997 at a Department of Energy Contract Review meeting. The meeting was highly attended by industry representatives.

